

8.3.12 Herring (*Clupea harengus*) in Subdivision 30 (Bothnian Sea)

ICES stock advice

ICES advises that when the MSY approach is applied, catches in 2017 should be no more than 134 556 tonnes.

Stock development over time

The spawning-stock biomass (SSB) has been above $MSY_{Btrigger}$ since 1987 and has been increasing since 1999. Fishing mortality (F) has been mostly below F_{MSY} although it was slightly above in 2012–2014. Recruitment has increased over time.

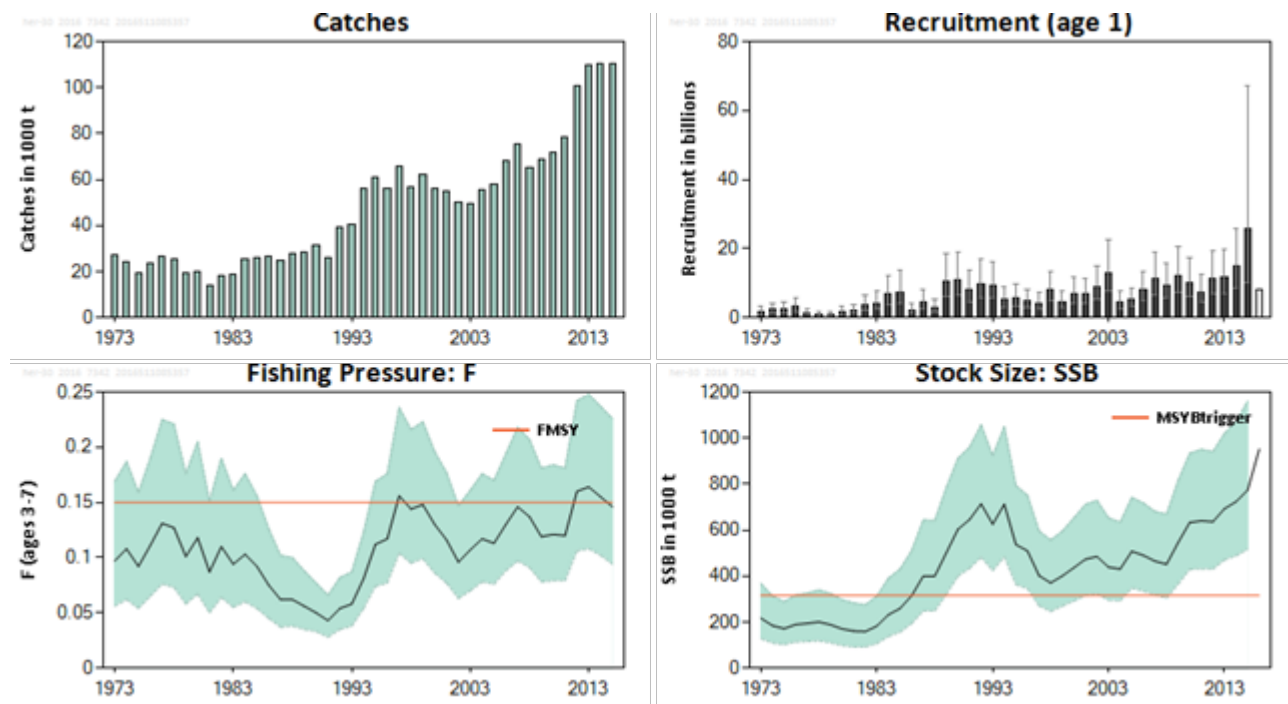


Figure 8.3.12.1 Herring in Subdivision 30. Summary of stock assessment (weights in thousand tonnes). Recruitment and SSB in 2016 are predicted. Recruitment, F, and SSB have confidence intervals (95%) in the plot. Assumed values are not shaded.

Stock and exploitation status

Table 8.3.12.1 Herring in Subdivision 30. State of the stock and fishery relative to reference points.

		Fishing pressure				Stock size		
		2013	2014	2015		2014	2015	2016
Maximum sustainable yield	F_{MSY}	✗	✗	✓	Appropriate Below potential candidate reference points	$MSY_{Btrigger}$	✓	✓
Precautionary approach	F_{pa}, F_{lim}	?	?	✓		B_{pa}, B_{lim}	✓	✓
Management plan	F_{MGT}	-	-	-	Not applicable	SSB_{MGT}	-	-
								Above potential candidate reference points
								Not applicable

Catch options

Table 8.3.12.2 Herring in Subdivision 30. The basis for the catch options.

Variable	Value	Source	Notes
F ages 3–7 (2016)	0.146	ICES (2016a)	$F_{(2015)}$
SSB (2016)	951537 t	ICES (2016a)	
R_{age1} (2016)	8032449 thousands	ICES (2016a)	Resampled from the distribution in 1990–2015.
R_{age1} (2017)	8797692 thousands	ICES (2016a)	Resampled from the distribution in 1990–2015.
R_{age1} (2018)	8032449 thousands	ICES (2016a)	Resampled from the distribution in 1990–2015.
Total catch (2016)	123143 t	ICES (2016a)	
Commercial landings (2016)	123143 t	ICES (2016a)	
Discards (2016)	0	ICES (2016a)	Discarding is considered negligible.

Table 8.3.12.3 Herring in Subdivision 30. The catch options. Weights in tonnes.

Rationale	Catch (2017)	Basis	F (2017)	SSB (2017)	SSB (2018)	% SSB change*	% TAC change**
MSY approach	134556	$F_{MSY} = 0.15$	0.15	1015837	978829	–4	11
F_{MSY} ranges with Advice Rule included [^]	100469	$MSY F_{lower(AR)}$	0.11	1021340	1016873	–0	–17
	159144	$MSY F_{upper(AR)}$	0.18	1011784	949517	–6	32
Zero catch	0	$F=0$	0	1036937	1134714	10	–100
Other options	109144	$MSY F_{lower(AR)}$ differing by 0.01	0.12	1019927	1007315	–1	–10
	117690	$MSY F_{lower(AR)}$ differing by 0.02	0.13	1018548	997789	–2	–3
	126170	$MSY F_{lower(AR)}$ differing by 0.03	0.14	1017192	988262	–3	4
	142807	$MSY F_{upper(AR)}$ differing by 0.02	0.16	1014484	968961	–4	18
	151069	$MSY F_{upper(AR)}$ differing by 0.01	0.17	1013133	959158	–5	25
	134556	F_{sq}	0.15	1015837	978829	–4	11
	768613	SSB 2018 = $MSY B_{trigger}$	1.41	856252	316000	–63	536

*SSB in 2018 relative to SSB in 2017.

**Catch in 2017 relative to TAC 2016 (120 872 tonnes for subdivisions 30 and 31 combined).

[^] Ranges with the advice rule (AR) advised by ICES in 2015 (ICES, 2015). Taking into account that $SSB_{2017} \geq MSY B_{trigger}$, $F_{lower(AR)}$ and $F_{upper(AR)}$ are not reduced by the factor $SSB / MSY B_{trigger}$ (ICES, 2015).

Basis of the advice

Table 8.3.12.4 Herring in Subdivision 30. The basis of the advice.

Advice basis	MSY approach.
Management plan	There is a proposed EU management plan for the Baltic Sea. The plan has not been formally implemented.

Quality of the assessment

The assessment results still show considerable uncertainties. It is anticipated that as the acoustic survey time-series becomes longer the stability of the assessment will improve.

There is uncertainty about the stock structure of herring in subdivisions 30 and 31.

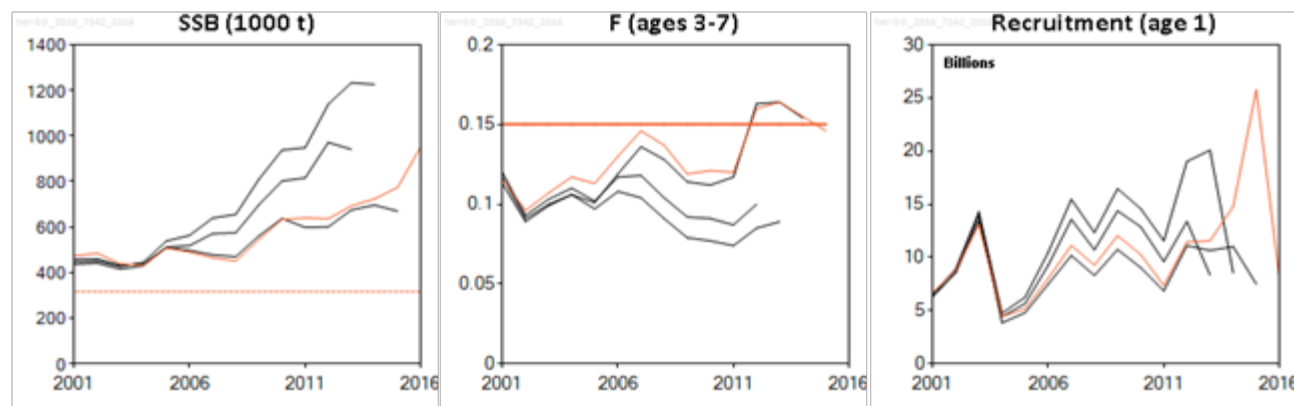


Figure 8.3.12.2 Herring in Subdivision 30. Historical assessment results (final-year recruitment estimates included).

Issues relevant for the advice

The herring stocks in subdivisions 30 and 31 are currently assessed separately, but they are managed by a common TAC. Adding up the catch advice for the two stocks in 2017 results in a total herring catch of 134 556 t + 6 442 t = 140 998 t in subdivisions 30 and 31 in 2017.

A combined TAC may pose a risk and not adequately protect the smaller stock. However, the recent development of both stocks and the current low fishing effort in Subdivision 31, suggest a low risk of overexploitation of the smaller stock.

Reference points

Table 8.3.12.5 Herring in Subdivision 30. Reference points, values, and their technical basis.

Framework	Reference point	Value	Technical basis	Source
MSY approach	F_{MSY}	0.15		ICES (2015)
	MSY $B_{trigger}$	316 000 t	The 2.5 percentile of the B_{MSY} distribution.	ICES (2013)
Precautionary approach	B_{lim}	Not defined.		
	B_{pa}	Not defined.		
	F_{lim}	Not defined.		
	F_{pa}	Not defined.		
Management plan	SSB_{MGT}	Not defined.		
	F_{MGT}	Not defined.		

Basis of the assessment

Table 8.3.12.6 Herring in Subdivision 30. The basis of the assessment.

ICES stock data category	1 (ICES, 2016b)
Assessment type	Age-based analytical assessment (SAM; ICES, 2015) that uses catches in the model and in the forecast.
Input data	Commercial catches (Finnish and Swedish landings, ages from catch sampling and survey, length frequencies from catch sampling) from 1973 to 2015; two tuning fleets: one acoustic survey, 2007 to 2015(3rd or 4th Q BIAS), and one commercial, 1990 to 2006 (trapnet). Annual maturity data from Finnish commercial trawl catches before spawning; natural mortalities (0.2 for all ages).
Discards and bycatch	Not included, considered negligible.
Indicators	None
Other information	Last benchmark in 2013 (IBPHer-30; ICES, 2013). A benchmark is scheduled for the two herring stocks (subdivisions 30 and 31) in 2017.
Working group	Baltic Fisheries Assessment Working Group (WGBFAS)

Information from stakeholders

There is no available information.

History of advice, catch, and management

Table 8.3.12.7 Herring in Subdivision 30. History of ICES advice, the agreed TAC, and ICES estimates of catch. Weights in thousand tonnes.

Year	ICES advice	Predicted catch corresp. to advice	Agreed TAC**	ICES catch
1987				25
1988				28
1989				29
1990				31
1991	TAC for eastern part of SD, allowance for western part	32+	84	26
1992	<i>Status quo</i> F	39	84	39
1993	<i>Status quo</i> F	39	90	40
1994	No specific advice	41*	90	56
1995	TAC	73	110	61
1996	TAC	73	110	56
1997	$F(97) = 1.4 \times F(95)$	78	110	66
1998	<i>Status quo</i> F	50	110	57
1999	Reduce catches	-	94	62
2000	Reduce catches	-	85	56
2001	$F_{pa} = 0.21$	36	72	55
2002	F below F_{pa}	53	64	50
2003	F below F_{pa}	50	60	50
2004	F below F_{pa}	50	61.2	55
2005	F below F_{pa}	60.2	64	58
2006	F below F_{pa}	88/93	91.6	69
2007	F below F_{pa}	83.4	82.8	75
2008	F below F_{pa}	67.3	87.0	65.4
2009	<i>Same advice as last year</i>	67.3	82.7	68.9
2010	F below F_{pa}	109.6	103.3	71.7
2011	F below F_{pa}	< 115	104.4	78.5
2012	MSY framework	104	106	100.6
2013	MSY framework (F_{MSY})	97	106	109.8
2014	MSY approach (F_{MSY})	138	138	110.5
2015	MSY approach (F_{MSY})	181	158	110.4
2016	MSY approach ($F_{MSY} = 0.15$)	≤ 96.613	121	
2017	MSY approach ($F_{MSY} = 0.15$)	≤ 134.556		

* Catch at F_{01} .

** TAC for subdivisions 29N, 30, and 31 (IBSFC Management Unit 3), and from 2005 for subdivisions 30 and 31.

History of catch and landings

Table 8.3.12.8 Herring in Subdivision 30. Catch distribution by fleet in 2015 as estimated by ICES.

Table 2: 2015 - Trawling in Subdivision 207, Catch distribution by fleet in 2015 as estimated by 2015.					
Total catch (2015)		Landings			Discards
110.4 kt	95% trawls	4% trapnets	1% gillnets		Discarding is considered to be negligible.
	110.4 kt				

Table 8.3.12.9 Herring in Subdivision 30. History of ICES landings for each country participating in the fishery. Weights in tonnes.

Year	Finland	Sweden	Total
1971	24284	5100	29384
1972	24027	5700	29727
1973	20027	6944	26971
1974	17597	6321	23918
1975	13567	6000	19567
1976	19315	4455	23770
1977	22694	3610	26304
1978	22215	2890	25105
1979	17459	1590	19049
1980	18758	1392	20150
1981	12410	1290	13700
1982	16117	1730	17847
1983	16104	2397	18501
1984	23228	2401	25629
1985	24235	1885	26120
1986	23988	2501	26489
1987	22615	1905	24520
1988	24478	3172	27650
1989	25453	3205	28658
1990	28815	2467	31282
1991	23219	3000	26219
1992	35610	3700	39310
1993	36600	3579	40179
1994	53860	2520	56380
1995	58806	2280	61086
1996	54372	1737	56109
1997	63532	1995	65527
1998	54115	2777	56892
1999	60483	1862	62345
2000	54886	1374	56261
2001	52987	1997	54984
2002	46315	3903	50218
2003	45932	3707	49638
2004	50236	5214	55450
2005	55422	2 520	57 942
2006	66962	1 403	68 365
2007	72116	3 317	75 432
2008	61756	3 674	65 430
2009	64881	3 992	68 873
2010	68760	1 755	70 515
2011	75130	3 370	78 500
2012	94248	6 392	100 640
2013	98935	10849	109 784
2014	97779	12755	110 534
2015	96414	14001	110415

Summary of the assessment

Table 8.3.12.10 Herring in Subdivision 30. Assessment summary with weights (in tonnes) and recruitment in thousands.

Year	Recruitment (Age 1)	High	Low	Stock size: SSB	High	Low	Catches	Fishing pressure: F (Ages 3–7)	High	Low
1973	1845019	3387829	1004801	216642	367368	127756	26971	0.097	0.169	0.056
1974	2267073	4098370	1254064	184425	313163	108610	23918	0.108	0.187	0.062
1975	2443642	4375100	1364857	171442	289150	101651	19567	0.092	0.159	0.054
1976	3220348	5828673	1779246	189283	316444	113221	23770	0.111	0.19	0.065
1977	1411269	2552133	780399	193881	325690	115416	26304	0.131	0.225	0.076
1978	903472	1651278	494321	200586	339531	118501	25105	0.127	0.221	0.073
1979	954554	1747785	521331	188339	324000	109480	19049	0.101	0.176	0.058
1980	1722005	3143791	943225	170246	297295	97491	20150	0.118	0.205	0.067
1981	1988716	3617450	1093310	160974	282807	91627	13700	0.087	0.151	0.05
1982	3474635	6309204	1913568	158736	274861	91673	17847	0.11	0.19	0.064
1983	4189115	7603354	2308019	182225	312581	106232	18501	0.094	0.161	0.055
1984	6742896	12197725	3727469	231654	390405	137456	25629	0.103	0.176	0.06
1985	7474442	13557901	4120644	258849	429957	155836	26120	0.092	0.156	0.054
1986	2184724	3993026	1195339	314268	510109	193614	26489	0.075	0.126	0.045
1987	4662209	8233156	2640081	399113	643039	247716	24520	0.062	0.102	0.037
1988	2972756	5289953	1670578	399113	641318	248381	27650	0.062	0.1	0.038
1989	10681245	18544059	6152321	501822	785645	320533	28658	0.056	0.088	0.035
1990	10897021	18732303	6339053	603198	911457	399193	31282	0.05	0.077	0.033
1991	7992387	13725143	4654104	644996	960414	433168	26219	0.043	0.066	0.028
1992	9781467	16742819	5714515	713544	1057206	481596	39310	0.054	0.082	0.035
1993	9360413	15976669	5484081	625308	923144	423564	40179	0.058	0.087	0.038
1994	5126840	8690143	3024632	712119	1049579	483158	56380	0.081	0.123	0.054
1995	5809471	9813799	3439030	536596	793588	362826	61086	0.112	0.169	0.074
1996	4891453	8206032	2915699	509406	751255	345414	56109	0.117	0.176	0.077
1997	4239687	7122718	2523608	401515	595526	270709	65527	0.156	0.236	0.104
1998	7936635	13406363	4698529	370275	556922	246180	56892	0.144	0.216	0.095
1999	4597393	7760521	2723532	399912	594467	269030	62345	0.148	0.223	0.099
2000	7046207	11894421	4174145	436263	652470	291700	56261	0.13	0.196	0.086
2001	6702559	11348090	3958754	473071	711535	314525	54984	0.116	0.177	0.077
2002	8797692	14839454	5215784	484562	728687	322223	50218	0.096	0.147	0.063
2003	13098392	22373326	7668411	438450	652183	294761	49638	0.107	0.161	0.07
2004	4434831	7515815	2616845	430628	634226	292389	55450	0.117	0.176	0.078
2005	5162854	8628317	3089253	507372	741240	347292	57942	0.113	0.17	0.076
2006	8032449	13394035	4817087	489921	717537	334509	68365	0.13	0.194	0.088
2007	11117155	18758171	6588656	464632	680375	317299	75432	0.146	0.218	0.097
2008	9258013	15650290	5476627	451351	668853	304577	65430	0.137	0.207	0.091
2009	12043071	20409275	7106355	545250	815437	364587	68873	0.119	0.181	0.078
2010	10252171	17336419	6062786	632857	933485	429046	71726	0.121	0.184	0.079
2011	7363162	12459077	4351538	639857	950212	430869	78500	0.12	0.181	0.079
2012	11444273	19296996	6787139	636029	940983	429905	100640	0.16	0.242	0.106
2013	11547736	19557707	6818295	692456	1019681	470241	109784	0.164	0.248	0.108
2014	14783171	25619389	8530342	722881	1071296	487780	110534	0.155	0.237	0.102
2015	25777176	67111099	9900937	773747	1159941	516133	110415	0.146	0.226	0.094
2016	8032449*			951537**						
Average	6924187	12383702	3898682	441121	653839	282509	48220	0.109	0.172	0.069

*Resampled from the distribution in 1990–2015.

**Predicted.

Sources and references

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